Pier 5 Redevelopment Project

EEOS 476

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Contents

Introduction

For environmental prospects and the focus of the Charlestown community and stakeholders, this project was focused on a Navy Yard "finger" pier, called “Pier 5’ located in Charlestown, Massachusetts at the mouth of the Mystic River and Charles River. This pier is part of Boston Harbor, which is a natural estuary system where the salty waters of the bay mixes with the fresh water of the three rivers, Charles, Mystic and the Neponset. This pier is conveniently nestled between an educational sailing center called *Courageous Sailing* on Pier 4 and a restaurant/marina called *Tavern on the Water* on Pier 6. The historical pier is surrounded by Boston Harbor waters’ to the north, south and east.

Pier 5 is proposed to be one of the largest area’s open for development in the Navy Yard, and soon city officials are going to be determining what it will be used for in future generations to come. For the past 20 years this site has been targeted for housing development however due to lack of funding these projects were ceased. Today, the Boston Redevelopment Authority (BRA) has opened the doors for new proposals at this deserted and unattractive pier. As owners since the Navy Yards decommissioning, the BRA will ultimately determine the future of the pier, and with visions of Pier 5 “going green,” it is an exciting project that one day will be given a chance to be revised and hopefully implemented.

The historical aspects of the pier contribute to the importance it has on its surrounding community of Charlestown and to Boston Harbor. With history provided by the Charlestown Navy Yard Visitor Center, the Charlestown Navy Yard was established in the 1800’s and was an important resource for the war efforts. The construction of the eleven piers in the area was necessary for the inception of war and to carry out the makings of missiles, an estimated 200 warships, and to establish shipyard technology.

The pier was originally built in 1911-1912, and was initially constructed of wood. It was measured to be only 372 feet long on the west side and 396 feet on the east side, with a width of only 75 feet. It was then rebuilt in 1941 now with concrete instead of wood. The new construction made the pier 125 feet wide and 650 feet long, and held the potential of being a heavy duty, working industrial wharf (NPS, 2010). Magnificent warships were born in the Charlestown Navy Yard and ships were constantly going in and out for repairs, refueling,

supplying, and daily maintenance for damaged ships that needed repair during the war.

After 174 years of partnership to the U.S Navy, Pier 5 was then sold to the Boston Redevelopment Authority in 1979 (NPS, 2010). To preserve the Navy Yards integrity in historical aspects, the *USS Constitution* and the *USS Cassin Young* are powerful Naval Ships that serve as reminders of the historical influence the yard played in the U.S. (Figs. 1 and 2).

Figure 1: Aerial view Charlestown Navy Yard January 1, 1966(DHF, 2000)

Figure 2 Modern day aerial view Charlestown Navy Yard(NPS, 2010)

With a surrounding community full of condominiums, especially Flagshipand Constellation Wharfcondominiums, apartments, new construction on certain parcels of other piers, restaurants along the waterfront, sailing facilities, and a beautiful harbor walk, the Boston Redevelopment Authority has come to terms that this area is important and needs attention.

With the help and support of the Municipal Harbor Planning Committee, The Charlestown community, The Boston Harbor Association, The Charlestown Waterfront Coalition, Friends of the Charlestown Navy Yard, and the Conversation Law Foundation, everyone can contribute important elements and voices in the Pier 5 compliance. Public participation in environmental enforcement, policy making and education is meaningful only if the public has the information necessary to make informed interventions. Providing access to information encourages citizen participation in ensuring environmental compliance.

As more investigation and observation ensues, this project incorporates coastal zone management, including that of water-dependent uses that this project will involve and stringent regulations, including the terms of Chapter 91 and the Massachusetts Public Waterfront Act.

Finding suitable sites for potential use and/or activity in the coastal environment is one of the most critical challenges facing coastal planning and construction due to coastal dynamics.

The primary goal for this redevelopment project is to be able to allow the pier to be useful for all. We believe the surrounding community is priority as well as an opportunity for students to have access to potential facilities onsite.

Methodology

The methodology that this project follows is that of a coastal zone management structure. The objectives and goals that are responsible in coastal planning and management of Pier 5 is smart growth innovation from coastal and marine resources,identifying the desired uses of the pier,minimize conflicts that can occur within the community, prevent environmental degradations of the Navy Yard and Boston Harbor, and ensure sustainability of Pier 5 and coastal waterfront.

When undergoing coastal zone management regarding the nature of the pier, one of greatest challenges of all is to place more attention on long-term management and policies, educating political leaders and the public about the need for stewardship within the Charlestown area. Taking into consideration the framework behind the new construction of the pier, certain principles that can guide the stability of the project are necessary.

The precautions taken are needed in order to perform a resource assessment plan of the pier, which includes physical, morphological and biological data to perform an impact assessment plan, such as assessing the coastal construction vulnerability to various activity impacts and cumulative impacts of such as sea level rise and erosion. Taking into consideration these future challenges of sea-level rise and erosion of the Boston waterfront, the planning the pier using “Smart Growth” innovation and design, which will be discussed later, is an important part in discouraging dangerous and irrational building patterns.

Precautionary regulatory measures are based on some form of scientific risk assessment. The precautionary principle, if in doubt, decides in favor of the environment and plays a

significant role in the current environmental and health laws and policies throughout the U.S. The degree to which we are prepared to take precautions is related to the intrinsic values which that we attach to nature, society, human well-being, and environmental restoration.

While uncovering the pieces to the puzzle of environmental integrity and precautions, the humility principle states "Our understanding of nature and how our actions affect nature is quite limited" (Miller, Spoolman 637.) With humility, humans need to realize that what is natural, used for resources, and part of the life cycle of the earth, is not meant to be over used or abused. In the end, tragic outcomes are happening due to people's lack of humility. To restore Pier 5 means to take consideration of this principle.

Pier 5 is a diamond in the rough, and its beauty and purpose can and will make a difference in Charlestown and Boston Harbor. The development of this pier is focusing its idea's toward an innovative design that will tend to the needs of the neighborhood and the harbor, including students from surrounding colleges, bringing in some old history of the area and creating new history as well.

So what could Pier 5 amount to? Will it be more condominiums, shopping centers, another museum, restaurants or an office building? This project made it possible for collaboration of new ideas with maintaining the need for a more "green" design of resource management and restoration that will lead to a sustainable future of the Navy Yard pier and the Charlestown community as well.

Pier 5 Layout

The design of the pier includes several waterfront activities, green space, and a research facility. Our goal for this redevelopment is to be able to allow the pier to be useful for all. We believe the surrounding community is priority as well as an opportunity for students to have access to potential facilities onsite. With proper use of modern green technologies, engineering and landscaping we can achieve these goals.

Based on the Environmental Protection Agencies' goals for clean water, within the Pier 5 design layouts we would incorporate the following:

- Soft structures integrated with the hard structures for water quality and protection
- Modern technologies for storm water management
- Include all of the Navy yard for soft structuring
- Implement alternative energy

The Pier 5 layout allows us to utilize the waterfront and its surrounding environment for the ever expanding energy needs of the project. Our first step is to include micro power energy solutions such as tidal and wind. Due to the small size of area to work with, these technologies will be utilized mainly for demonstration purposes and research. Many companies across the country have proposed designs that would fit perfectly in this location.

Puget Sound Tidal Power has designed scaled down turbines that would generate 10-15 kilowatts at a low cost (Kanellos, 2007). Compared to larger turbines that cost millions of dollars a unit these micro turbines range around $10,000 per unit (Kanellos, 2007). The amount of energy generated is enough to power 4-5 homes would be plenty for pier lighting and public facilities such as restrooms. By possibly lashing several of these together generating the entire energy budget for the pier could be plausible. Each turbine has a height of 15 feet; therefore, location for these turbines needs more research to avoid navigation channels and placed in deeper parts of the harbor to be practical.

Micro wind turbines could be an approach to be considered because they can be less invasive as compared to tidal projects. A small wind turbine is technologically advanced but mechanically simple, with only two or three moving parts (AWEA, 2008). Technology in the past few years has made wind turbines quieter, more reliable and better able to blend in with surrounding aesthetics thus making small turbines an attractive pick for water fronts. Most feature three blades 2-15 feet in length, generator, and a tail mounted on steel poles ranging from 35-140 feet high (AWEA, 2008). These turbines are still capable of creating .04 kW a turbine to 10kW (AWEA, 2008). See Figure 3 below for size comparison between wind turbine designs.

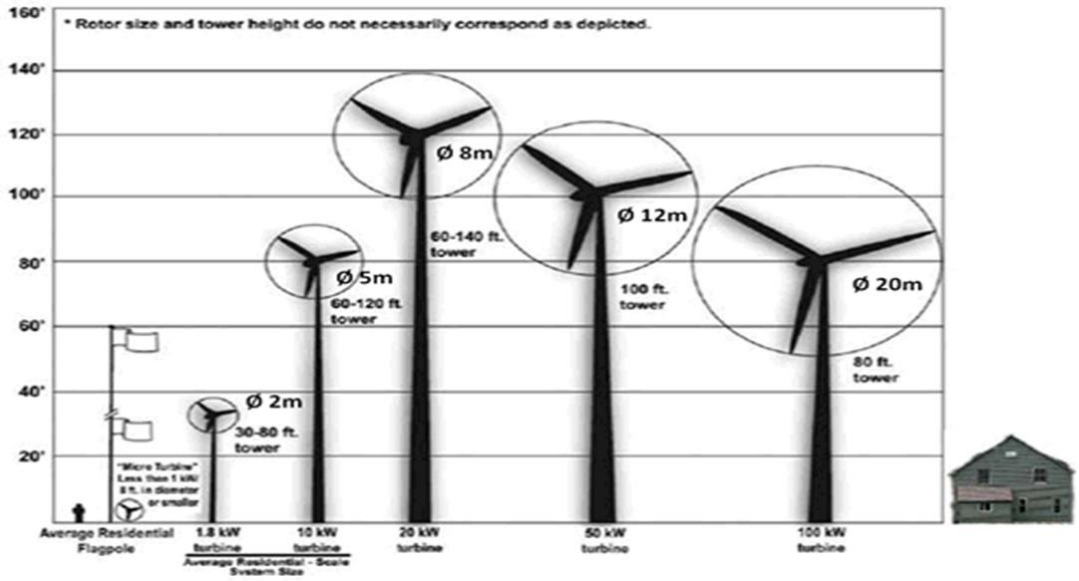


Figure 3: Size comparison chart of common wind turbine sizes(AWEA,2008)

These turbines could be used in conjunction with the tidal systems to supplement areas in need of energy. When paired together with other turbines enough energy could be generated to provide for the minor needs on the pier such as lighting, restrooms and other small needs.

The master design of the pier focuses on maximizing the space provided while still allowing for the natural environment to thrive and providing the community with something useful and beautiful. With this said, we will strive to make this pier entirely sustainable and clean. However, based on aesthetics, hindering natural environment, possible Chapter 91 violations and commercial processes relying entirely on wind and tidal projects may not be sufficient. We will as part of the project have at least one small tidal turbine and one small wind turbine for research and display purposes. This site could be used to try out new small systems as part of research conducted at the facility which will be powered by solar panels and constructed with the highest building efficiency ratings. Through trial and error, just attempting these technologies at this site will possibly pave the way as a model for other waterfront projects in the future.

The layout and overall “look” of the pier will include and incorporate community wishes for green spaces, educational opportunities and sustainable design practices. The green space

design layout on top of the pier includes trees, permeable walkway surfaces and plants to provide an environment desirable by all. The focus will be on the aesthetics and the functionality of the space. For functionality, the space will provide a natural solution for runoff, noise pollution and sun protection.

As part of Boston's Harbor walk system, a paved trail circumnavigating most of the city's water front, this location will be a desirable destination for picnics, relaxing amongst the trees and enjoying nature and technology at its finest. Again, the technology used on this pier can be used as a model for other pier redevelopment projects as well as water fronts across the world.

Using the natural slope of the land leading up to all piers our goal is to develop a system where salt marshes can be placed underneath the pier. As part of our "smart growth" strategy to combat projected sea level rise and future coastal problems the use of these natural systems will be paramount. Our design includes the current pier with floating salt marshes and oysters hanging from the pier. These natural bio indicators will assist in rating the water quality changes via the health of the organisms. With the incorporation of YSI probes, manufacturer of sensors and instruments to test water quality, we could develop a design to run these sustainably with green roofs or other alternative energy. Other research ideas are some MIT designs such as the electric boat and sea perches for research along with outreach and education.

The infrastructure of the pier may not need to be changed due to the depth of the water in those areas. Our design paired with the floating salt marshes and hanging oysters will include salt marshes under the pier. This landscaping design is credited to Boston Architectural College students, who created several designs including this one during our research (Fig.4).

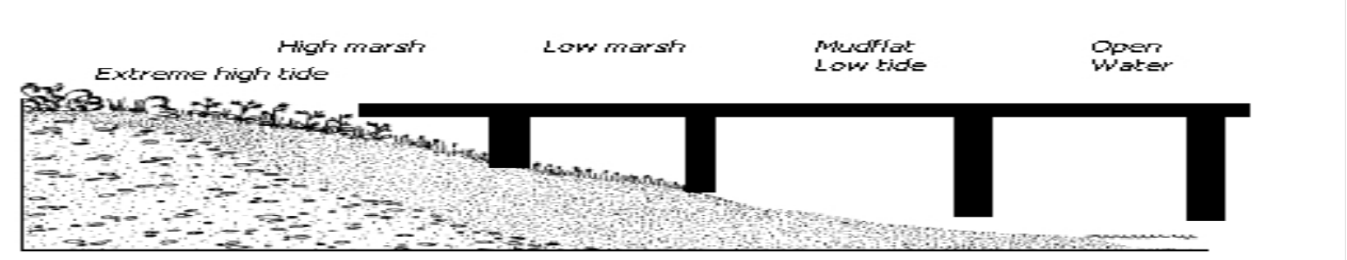


Figure 4: Proposed layout for salt marsh underneath the pier. (Image credit: www.bofep.org with addition by Michael Grealish)

The goal to make this site an outreach and learning center is extremely important to us and for stakeholders involved. Paired with learning we want community uses to range from a public marina to a place to work out. The layout of the pier will allow us to include these uses in the master plan. Referring to the harbor walk system this destination could be a much desirable spot for recreational uses as well as places to just relax.

Boston harbor for many years has been an excellent location for all types of boating. With the various types of boating brings the needs of different types of marinas and docks. We plan to include a type of marina, much like the one at Spectacle Island, which is open to the public. These docks only require a small donation for upkeep and are a much more viable option when compared to the private docks in the area. This would provide an attractive option for the casual recreational boaters. Not only would this attract people to use these docks because of the minimal fees it would bring much more people to the area. This area, outside of the tall ships festival, is starved for tourist and economic attention. These types of marina and dock systems would provide a much needed economic boost and also attract outsiders to the beauty of Pier 5 thus making a design like ours a smart option for future pier projects.

The last goal of the pier layout is by far the most important and most dynamic. Focusing again on education and community outreach we plan on developing a "discovery center" to provide people with a unique learning experience. An approach such as this has been developed by LOT-EK and Youngwoo& Associates were chosen by the Hudson River Park Trust to redesign pier 57 in New York (Schwartz, 2009). Their design features low rent spaces for small businesses, a green space, and a contemporary culture center filled with entertainment, auctions, galleries, underwater discovery center and seasonal docks (Schwartz, 2009). Due to the size and other uses in the Navy Yard area we would be limited on business uses; however, we would indeed adopt a plan to include the discovery center, docks and green space.

The layout of Pier 5 would allow us to incorporate this design to include the "discovery center" approach. Underneath the pier we plan to revive the natural processes found in most productive coastal zones. Processes such as how oysters filter water and how salt marshes work to create a natural buffer would be on display. Paired with these "processes on display" we would attempt, with hopeful water quality improvements, to display sea life found in the harbor waters. An aquarium view would be the goal underneath the pier at its outermost part. This

would allow the community and visitors to experience the harbor in ways they never could imagine on top of learning about the natural processes occurring (Fig 5).

Figure 5: Pier 57, New York City, proposal design for an underwater discovery center(Schwartz, 2009)

On the inner part of the pier, where the salt marsh will be, we would arrange for viewing from above. The pier itself is 75 feet across and this viewing area from above would require a 25x25 feet hole cut into the pier to provide this. The focus of this design is to provide visitors a bird's eye view of the salt marshes below. Alongside the view we would also offer informational podiums describing the salt marsh species and benefits. This will be the gateway for the rest of the pier and help to express the focus of the pier.

Proposed Scenario for Pier 5

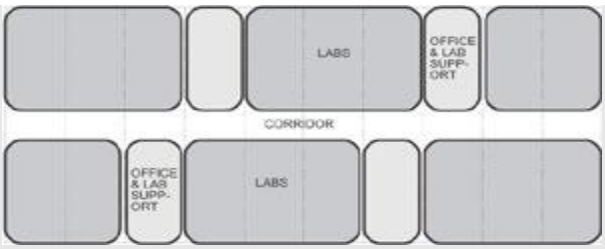
The preliminary design of the pier includes several waterfront activities, green spaces and community involvement surrounding the centrally focused multi-disciplinary science research facility. The research facility's main focus would be marine biology. We would also push for water quality laboratories, oceanography, sea level rise testing, biodiversity monitoring as well as laboratories and classrooms for students on all levels. The design of this building would call for a minimum level facility to exceed no more than two floors but include the latest technologies in energy and building design.

The objectives for this facility are to create a laboratory environment that is responsive to current and future needs of the area. With the creation of a successful lab planning module this facility should successfully meet all of the above goals. Due to size restrictions with using a pier the design will use the maximum amount of space allowed by law and achieve the highest LEED certification. However, the goal is to not interfere with the natural beauty of the harbor and allow space for other uses on the pier. Also included in the layout will be the incorporation of "wet laboratories" that can be placed pier side.

In order to accommodate all the aforementioned sciences and research goals we need to develop a facility that allows for flexibility. We will choose an open three dimensional lab module design that will require:

- a basic or two-directional lab module
- all vertical risers must be fully coordinated
- mechanical, electrical and plumbing systems must be coordinated in the ceiling to work with multiple corridor arrangements and the pier layout (Tolat, 2010)

This approach will allow us to incorporate green roofs and alternative energy infrastructure. This facility will be the only standing building on the pier therefore to able to display a green roof would provide us an opportunity for education and also assist in storm water management. The facility will be very small in scale and have only two working laboratories with some small office spaces for support. The single corridor lab design will be the best use of minimal space and permit flexibility of spaces (Fig. 6). The location for this site will be at the outermost portion of the pier directly above the "discovery center". This would place the building in the least invasive location in regards to views and aesthetics of the rest of the pier. Also placing the facility at this site would be the most cost effective if incorporated with the construction of the discovery center.



Single corridor lab design with office clusters accessing main labs directly

Figure 6: Single corridor laboratory design layout (Daniel Watch and DeepaTolat, WBDG)

As part of the marina this facility will have access to the docks for "wet" laboratory work as well as research vessels. The facility will require the highest technologies in regards to building efficiency and being able to accommodate all levels of research activities necessary. In order to remain a completely sustainable and environmentally conscious building we would need to follow the LEED guidelines closely. Outlined below are the minimum requirements for LEED certification for new construction designs (USGBC, 2011):

1. Must comply with environmental laws
2. Must be a complete, permanent building or space
3. Must use a reasonable site boundary
4. Must comply with minimum floor area requirements
5. Must comply with minimum occupancy rates
6. Must commit to sharing whole-building energy and water usage data (USGBC, 2011)

We have the benefit of starting from scratch and following these guidelines should not pose a problem as the project comes into existence.

The energy needed for a small facility can be provided on a sustainable and clean level with the proper design and layout. The goal is to run the entire facility by the solar panels supported on the roof as part of the green roof. This applies to solar thermal heating and solar power systems. This approach will provide us with the ease of installation; reliable stability of solar units from load of the green roof buildup and higher efficiency of the photovoltaic-module due to the cooling effect of the green roof (IGRA, 2011). This design only allows for extensive vegetation to be installed and the solar units have to be installed above the vegetation level so

that the panels are not shaded. Special frames of aluminum are made in order to put the panels at the required level however we would vie for a framework which is mounted to plastic boards. These profiled plastic boards are covered with substrate and allow rain water to drain through; thus allowing plants to grow underneath the solar panels (IGRA, 2011). Considering the prevention of roof damage, by mounting the solar panels on the plastic boards the load distribution is spread over a large area. By using these solar panels, combined with the building efficiency design, the energy goals of the facility will be exceeded and completely sustainable.

Boston Harbor Water Quality

It is observed that the water quality of Boston Harbor has improved dramatically over the past decade. The Massachusetts Water Resources Authority and the Boston Water and Sewer Commission are responsible for implementing policies, laws, monitoring, and projects to better Boston Harbor, which resulted in the spending of millions of dollars for cleaner water quality. The goal to better the water quality is assessed with yearly reports and gathering of data of Boston harbor. These reports let the public know that improvements are being made in order to resolve the long-time bacteria problems that are associated with wastewater being discharged into Boston Harbor, by combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs), illegal dumping and boating pollution(The Boston Harbor Association, 2011).

The Massachusetts Water Resources Authorityhasmonitored the water quality of Boston Harbor and Massachusetts Bay since 1984(MWRA, 2011). Evidence that water quality has improved is reported in the MWRA's Drinking Water Test Results “Here’s To Water!” published June, 2010 by theMassachusetts Water Resources Authority. But, improvements still need to be made in order to have sustainable water and sewer treatment plans. The Boston Harbor Association claimed that “Approximately $420 million is being spent to completely eliminate combined sewer overflows from the Boston Harbor beaches by the year 2008”(The Boston Harbor Association, 2011).Complying with the Clean Water Act in important in Massachusetts in order to improve and control water pollution sustainably.

Improving the Water Quality at Pier 5's Research Center

The biological indicators that we would implement to improve the water quality conditions at Pier 5 would be a salt marsh and shellfish (e.g. oysters, blue mussels). These are important monitoring tools that can let us know if the quality of water is improving or not improving. At the research center on Pier 5, the water quality indicators to be measured in order to observe changes and to show that further improvements need to be made would be: nutrients, pathogens, metals, pH, toxicity, dissolved oxygen, temperature, water clarity, and other toxic contaminants.

At the research center at Pier 5, a vision of a salt marsh being established under the pier is necessary to educate people how water quality can improve with salt march restoration. A salt marsh is a highly productive wetland and provides the ecosystem with many "goods" and "services." It serves as a natural revenue and provides a wide range of highly valued resources, such examples are creating biodiversity, serving as feeding, migratory, nursing habitats for many species, and acts like a natural cleaning and recycling center, where it is reimbursing the ecosystem everyday with its inherent benefits and essential qualities by improving water quality and providing protection to the Pier 5 shoreline.

The primary service that the salt marsh would provide is being a natural buffer to the area where it is constantly capturing, filtering, and diluting wastewater and sediments that flow into it from the Charles and Mystic River. Many pollutants from run-off, boating activity, and CSO's are soaked up in the salt marsh. The salt marsh provides this valuable ecological and waste treatment service that leads to significant improvements in water quality and clarity by helping reduce nonpoint source pollution.

Another service observed is nutrient cycling, "the microbial community in a salt marsh is primarily responsible for decomposition and cycling of nutrients**"** (Ocean and Coastal Resource Management, 2011). Organisms in the salt marsh process organic material to release carbon and other nutrients such as nitrogen, and phosphorus between the different trophic levels in the ecosystem. The service provided by the salt marsh contributes in reducing eutrophication and to

improve CO_2 absorption, which is important to the health and well-being of species and humans as well.

Additionally, provided is flood and shoreline protection from major storms, and protection of groundwater resources, serving as a transition between saline and freshwater resources. The salt marsh acts like a sponge from rainfall and can protect areas surrounding the salt marsh such as houses, businesses, and roads from overflowing with water, reducing the severity and frequency of flooding.

One moreecological service is the biodiversity that the salt marsh offers. Salt marshes are studied as natural and suitable sites for species of shellfish, fish, crabs, birds and cord grasses. The *Boston Harbor walk Association* explained that "While providing ample opportunities to observe wildlife, the marshes are important nursery habitat for smelt and productive shellfish beds(DCR, 2011).

Lastly, the salt marsh provides is the natural scientific information. Cycles and processes of salt marshes can educate and teach many people about our how our earth functions and how a salt marsh can clean up water. With attaining this valuable knowledge, new ideas and restoration projects can be improved.

Shellfish Enhancement

Having shellfishdisplayed at Pier 5 for educational purposes and for the research center is a vision that is part of the Pier 5 project.Boston Harbor would be a suitable habitat to display shellfish enhancement as part of the pier layout. The shellfish would be placed inside unique shellfish bags that would be mounted on both sides of the pier for everyone to see. Specifically used for water quality purposes and not for consumption, the essential functions of the shellfish would educate and display the quality uses of using shellfish to clean our harbor by improving the water quality.

The oyster *Crassostreavirginica* is a "suspension feeder which retains suspended particulate material on its gills. These are lamellar and composed of rows of filaments in groups that constitute folds (plicae) in the lamellar surface" (Nelson, 1960). These oysters will help to

minimize the effects of CSOs and SSOs that are in the area surrounding Pier 5,set an example for other coastal states, promote biodiversity, sequester excess nitrogen in waste water,algae, water-borne nutrients, and pollutants. Each oyster, depending on age and size, can filter up to five liters of water per hour which equals up to thirty gallons of water a day (Nelson, 190). The reasons why the oysters would part of the pier five projects are to create some sense of quality control within the harbor and for the waters surrounding Pier 5. The chronic discharge of pollutants systematically degrades the quality of the water and the oysters can counterbalance point pollution sources such as partially treated sewage from CSOs.

Economically speaking,the state could phase out expensive water treating methods and the improved water quality will increase tourism, recreation and fishing within the area.

The need to reduce discharges to Boston Harbor: CSOs & SSOs

Boston's treatment plant discharges to the harbor are a sustainability problem that merits attention because of CSOs, which discharge a mixture of storm water runoff and sewage directly into the harbor during heavy rainstorms and SSOs. In these separate sewer systems, overflows of sewage from manholes in residential areas, cities and towns, and underground sewerage structures can and do occur, causing an environmental policy issue. Unlike combined systems, separate systems have the intention of keeping sewage and storm water separate. Sewage is transported to wastewater treatment facilities, while storm water is discharged, causing serious water pollution in our harbors and the area surrounding Pier 5.

Since 1987, there were a total of eighty-four active and uncontrolled CSOs discharged combined flows into Boston Harbor, the Charles River and Mystic Neponset Rivers, causing the closing of many of the clam beds and beaches in Boston Harbor and Quincy Bay (Kales 32). Biologists observed that there were many species of fish dying in the area, sporadic outbursts of red-tide on the beaches, and severe sickness to anyone who went swimming in the harbor. In terms of sustainability, because of system neglect, overlook and deterioration, even in dry weather there were times and sites where combined sewers overflowed, making the CSOs and SSOs completely unsustainable.

A solution for this environmental policy issue is that communities in our metropolitan and suburban areas around Boston will definitely have to continue to allocate resources to sustain and improve local storm drainage and sewer systems. In 1994, MWRA prepared a "System Master Plan" which included an integrated, system-wide approach to wastewater treatment, wastewater conveyance through the interceptors, and combined sewer overflow management and remediation (Gong 113). This will ensure that our waterways are sustainable, maintained, healthy and safe for future generations. Another solution is to alleviate sewer backups into streets and buildings and minimize overflows into rivers, streams, and wetlands. Basically, MWRA needs to repair and replace vital parts of the aging sewer interceptor system. Sadly, due to the years of on-going pollutants entering the harbor and waterways, the effects of the discharges near Nut, Moon, and Deer Islands of solids, nutrients, and toxiccontaminants that have been developing over a century will take years to reverse, if perseverance solutions aren't taken seriously for the future. If these matters can be treated, the harbor and beaches can be cleaner in the summer, with less green algal growth, less pollution to species such as horseshoe crabs, oysters, bottom-dwelling fish communities near the outfall areas and treatment plants. The plants and animals can flourish and thrive as they recover from the effects of accumulated organic matter and toxic contaminants caused by the CSOs and SSOs.

The approach to these solutions is that routine maintenance activities need to be executed, making sure tide gates are working properly, sewage treatment plants are being supervised accurately, and maintenance and adjustments need to be arranged to the treatments plants that are already established. These improvements will and should provide substantial benefits to water quality throughout the river basins in greater Boston and in the harbor.

Data suggests that more needs to be done to improve our waters and can be seen in the Boston Harbor & Rivers Water Quality Report of December 2009. *E. coli, fecal coliform*, and *enterococcus* are water quality indicators, meaning high fecal *coliform* counts and *enterococcus*signal potential public health threats. "These can also be affected by environmental factors like temperature and rainfall, as well as discharges of contaminated storm water or CSOs" (MWRA, 2011). Figures 7 and 8 below show how many areas are still producing high numbers of these microbial pathogens, especially the CSOs that line Mystic River and the Charles River, where Pier 5 is located at the mouth of this watershed. More improvement clearly needs to be done to downgrade these numbers.

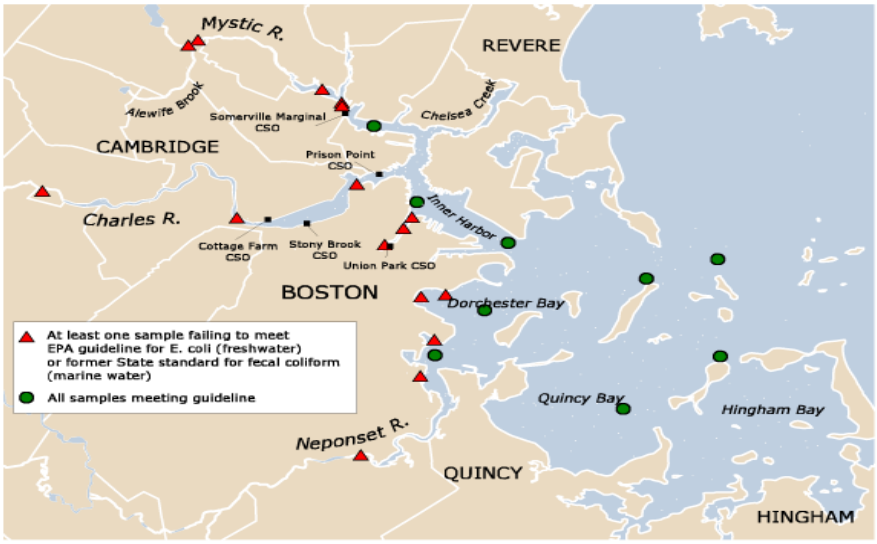


Figure 7:*E. Coli& fecalcoliforms*(Department of Marine Fisheries, 2011)

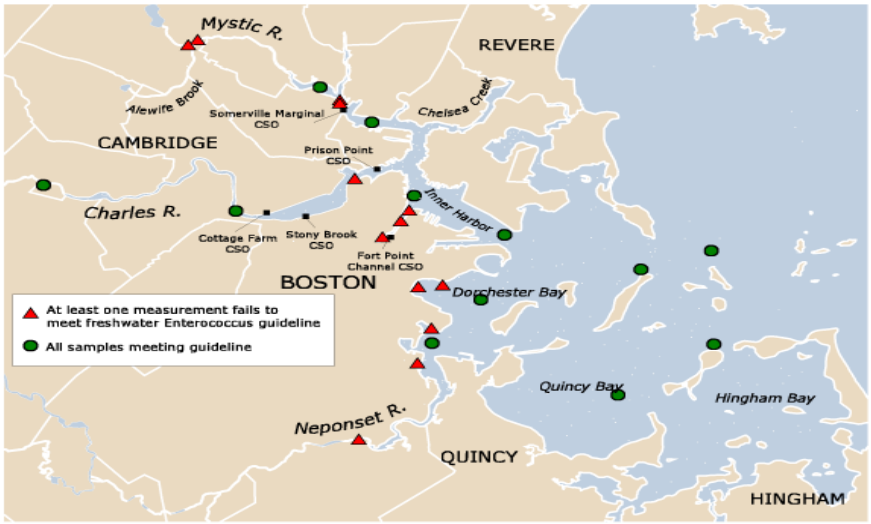


Figure 8:*Enteroccocus*(Department of Marine Fisheries, 2011)

Boston was considered one of the dirtiest harbors in the Nation, dating from the 1980's, now that goals, projects, and remedies are being put into operation, a bright future for the waterways and Boston harbor and Pier 5 can be seen(MWRA, 2011). Pier 5 can be the last resort for the quality of water to be cleaner coming into the harbor. Soon beaches around the city will not have

to put up red flags anymore to let people know swimming is not allowed due to sever bacteria counts in the water and maybe someday people can enjoy their harbor, free of pollution.

Policy and Regulations

The greatest challenges for pier 5 redevelopment are not technical, but rather financial, political and regulatory. This development plan will not, at the present time, address the financial and political hurdles on a micro level. Throughout the development process we will have to abide by strict regulations set forth for waterfront, historic and sustainable type construction. By referencing the terms of chapter 91, part of the Massachusetts Public Waterfront Act, we have considered the entire criterion necessary (Mass DEP, 2011). Other regulations we considered include State and local regulations for types of renewable energy, LEED certifications, Oceans Act of 2008, ACECs, DPAs and TURA planning and reporting (Mass DEP, 2011).

When considering the various types of energy needs this project requires one must incorporate the specific guidelines needed for proper permitting. Under a Chapter 91 license there are two types of uses: water dependent and non-water dependent (Mass DEP, 2011). Water dependent require direct access to or a location in tidal or inland waters (Mass DEP, 2011). Non-water dependent do not depend on proximity to water (Mass DEP, 2011). Based on the location of the site this license is very relevant.

Based on the size of the project pier 5 would fall in the category of accessory renewable energy facility. This is a designation given to project plans attempting to offset all or a portion of their energy costs via renewable energy and not contributing to the power grid. The general guidelines for siting common accessory renewable energy include, not limited to, the following:

- Avoid impacts to navigation and public access for solar panels, geothermal and wind turbines
- Minimize interference with navigation and other water-dependent uses for wave, tidal and current turbines

The underlying points of these regulations are to insist that these technologies do not interfere with anything and provide the maximum benefit. The standard license term is 30 years with extensions based on the degree to which the project supports broad environmental policies of the commonwealth, such as increasing the state's renewable energy resources, and other water-related public interests (Mass DEP, 2011).

Conclusions

At the closing stages of our project we have experienced several real world problems associated with project proposals and incorporating an entire community on a development. Throughout the course of the past semester we have reached out to themember of the Steering Committee MyRWInitiative, Ivey St John, and the Boston Redevelopment Authority for insight and project ideas. We have noticed that these issues can be extremely difficult to coordinate and often the community is left on the outside.

After meeting with Ivey we were left with a great appreciation for the history of the Navy yard as well as gratitude for the amount of effort some community groups place on these types of developments. Our goal for our proposal was to include all members of the community and the interested contractors. However, without the community's knowledge and consent, the BRA allowed an outside contractor to begin a project on the Pier 5. This occurred without the community's involvement and to make matters worse these contractors used the precious contacts with stakeholders and universities that the community groups have obtained.

Throughout this process thus far we have learned some valuable lessons that occur during these types of projects. We will continue with our proposal and maybe we can turn some heads for other redevelopment sites in the future. Overall, this will pave the way for our learning and will allow us to make the contacts needed for future projects.

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